1,068,432

# PATENT SPECIFICATION

DRAWINGS ATTACHED

1,068,432

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**Int. Cl.:**—D 04 h // B 32 b, D 03 d

COMPLETE SPECIFICATION

## Non-Woven Fabric, Tufted Carpet and methods of producing same

We, BIGELOW-SANFORD, INC., a corporation organised under the laws of the State of Delaware, United States of America, of 140 Madison Avenue, New York, State of New York, United States of America, do hereby declare the invention, for which we pray that a parent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to improvements in tufted pile fabrics such as carpet and to the method of producing the same. It relates, more particularly, to tufted pile fabrics such as carpet in which the pile elements are formed and supported on a non-woven backing fabric and the method of producing the same. The invention further relates to a non-woven fabric for use in such tufted pile fabrics and to a method of forming the same.

Tufted pile fabrics such as carpet which are made in accordance with the subject invention employ a novel, non-woven fabric as the backing or support for the pile elements and it will be understood that the present invention relates to the non-woven fabric as an intermediate product and the method of producing such non-woven fabric.

An object of the present invention is to provide a tufted pile fabric suitable for use as carpet having a non-woven backing fabric which imparts superior qualities to the pile fabric in a number of respects such as cost, weight, strength, dimensional stability, handle, availability of materials and the like, particularly in comparison to tufted carpet using a loosely woven backing fabric of burlap such as is commonly produced and sold commercially. In this connection, it should be noted that a non-woven backing fabric for tufted carpet embodying the present invention can be produced at a relatively high rate of productivity from inexpensive materials which are readily available in most countries. This eliminates problems of long delays and uncertainties of delivery which are frequently encountered in obtaining the commonly used loosely woven burlaps which are usually manufactured from jute in countries such as India and Scotland.

In addition, a non-woven backing fabric in accordance with the present invention has a consistent uniformity in composition which practically eliminates irregularities or imperfections in the appearance of the pile face of the tufted carpet due to the needle deflection which can occur when a tufting needle strikes a woven strand of material such as jute. The present non-woven backing fabric also provides better closure on the pile-forming yarns after tufting than loosely woven material such as burlap and it has greater ability to pick up the adhesive back-coating which holds the pile-forming yarns in place without objectionable penetration of the back-coating onto the face of the fabric.

In addition, tufted pile fabrics embodying the present invention are lighter in weight than tufted pile fabrics which use burlap as the backing fabric, and have comparable tufts or pile with the result that shipping costs are reduced and larger rolls can be handled.

Various other objects and advantages of the present invention will become apparent and will be better understood from the following description and the accompanying drawings in which:

Fig. 1 is a side elevational view in vertical section diagrammatically illustrating a piece of tufted carpet embodying the present invention;

Fig. 2 is a side elevational view in vertical section diagrammatically illustrating a piece

of the non-woven backing fabric of the tufted carpet shown in Fig. 1 but on an enlarged scale and in the form of a needled bat prior to surface treatment;

Fig. 3 is a plan view diagrammatically illustrating part of the non-woven backing fabric shown in Fig. 2;

Fig. 4 is a side elevational view diagrammatically illustrating the piece of non-woven backing fabric shown in Fig. 2 after surface treatment;

Fig. 5 is a side elevational view in vertical section diagrammatically illustrating the piece of non-woven backing fabric shown in Fig. 4 with yarns forming pile elements tufted thereon;

Fig. 6 is a side elevational view in vertical section diagrammatically illustrating a part of the tufted carpet shown in Fig. 1, but on an enlarged scale;

Fig. 7 is a side elevational view in vertical section diagrammatically illustrating a modification of the non-woven fabric as shown in Fig. 4;

Fig. 8 is a side elevational view in vertical section diagrammatically illustrating a piece of tufted pile carpet with the modified form of non-woven backing fabric shown in Fig. 7;

Fig. 9 is a plan view diagrammatically illustrating the apparatus and procedure employed for making the non-woven backing fabric shown in Fig. 4; and

Fig. 10 is a side elevation of the apparatus and procedure shown in Fig. 9.

It will be understood that the accompanying drawings are merely diagrammatic illustrations and that reference should be made to the following description for a more detailed explanation of the structures involved. Also, it should be understood that the thickness of the backing fabric used in actual practice will be of the same relative order as a woven burlap.

Generally speaking, a tufted pile fabric such as carpet made in accordance with the present invention employs a non-woven backing fabric as a support for yarns forming the pile elements. Prior to tufting, the non-woven backing fabric is in the form of a bat of filaments or fibers of synthetic thermoplastic material of high strength, particularly polypropylene. The fibers used may be what are termed "waste" in the trade. The bat is formed by distributing the fibers at random in one or more superimposed layers and then needling the layer or layers of fibers so as to cause them to be intimately intertwined and interengaged with each other throughout the thickness of the bat, particularly at the points of needling. After needling, the fibers on at least one exterior surface of the bat are bonded or fused together to a flattened and hardened condition as by melting the surface fibers without bonding or fusing the fibers on the interior of the bat. The bonded or fused exterior surface or surfaces of the bat increase its tensile strength to some extent, but more importantly this condition enables the non-woven fabric to pass more readily beneath the needles of tufting machines during the tufting operation and without interference or objectionable drag.

The usual tufting machines are employed in forming the pile elements and needles which carry the tufting yarns to form the pile elements, penetrate the non-woven backing fabric from the rear face thereof and form yarn loops of a desired length extending from the front face thereof. The needles with the yarns are then withdrawn from the backing fabric and the backing fabric is advanced to the point where the next pile element is to be formed.

It should be noted here that needle-punctures of the backing fabric which take place in the tufting have the effect of compacting the filaments or fibers of the non-woven backing fabric adjacent to the punctures and increase its tensile strength even though such punctures are made at closely spaced intervals by the tufting needles.

After the formation of the tufted pile elements has been completed, a suitable adhesive back-coating compound, such as a high-solids synthetic latex adhesive compound of the type usually used for tufted pile carpet is applied to the rear face or back of the carpet to secure in place the portions of the yarns forming the pile elements which extend across and through the backing fabric.

Referring now to the drawings, Fig. 1 illustrates a tufted pile fabric 11 of the type suitable for use as a floor covering or carpet which may hereinafter be called tufted carpet or tufted pile carpet. However, it will be understood that the present invention is not necessarily limited to tufted pile fabrics for use as floor coverings, although such use has particular advantages.

As shown in Figs. 1 and 6, the tufted pile carpet 11 comprises a non-woven backing fabric 12 having tufted pile elements 13 in the form of loops of yarn supported thereon. The yarns forming the pile elements are stitched to the non-woven backing by means of a tufting machine of a type customarily employed for such purpose and hence, need not be described in detail here. In addition, there is a coating 14 of an adhesive compound, such as a synthetic latex-based compound, on the back or rear face of the non-woven backing fabric which secures portions of the yarns forming the pile elements to the backing fabric in such a way that the yarns will not unravel readily or be pulled from the carpet under ordinary use.

The non-woven backing or supporting fabric 12 is comprised of fibers of thermoplastic material, such as polypropylene, which are distributed at random and which have been needled into the form of a cohesive bat or web. The needling causes fibers from different levels

of the bat to be intermixed in more intimate engagement with each other which imparts strength to the bat or web. A closed barb needle of small diameter, such as a No. 32 fine-felt triple-barb needle, may be employed for this purpose.

As shown in Figs. 1 to 6, the bat may include a piece 15 of low-count cheesecloth or other suitable material extending therethrough on which the fibers are deposited and which serves as a conveying element in transporting the initial layer or layers of fibers prior to formation of the web by needling. However, other means, such as a continuous moving belt of slats or the like may be provided to support and transport layers of fibers deposited thereon prior to needling and the cheesecloth may then be eliminated. A modified form of the backing or support fabric eliminating the cheesecloth is illustrated in Fig. 7 and the same reference numerals have been applied to corresponding elements. This form of backing fabric after tufting and backcoating is also shown in Fig. 8.

The backing or support fabric may be made entirely of polypropylene fibers or polypropylene fibers may be mixed with fibers of other materials such as nylon, rayon, acrylic, polyester or mixtures thereof. Polypropylene fibers have been found to have especially suitable characteristics particularly for use in conjunction with tufted carpet and are readily available in good supply in most countries, at low cost. It has also been found that satisfactory non-woven backing or support fabric for tufted carpet may be made from polypropylene fibers of 5 to 15 denier which are commonly produced commercially and fibers known as "waste" fibers in the trade may be used.

After needling, fibers on an exterior surface of the bat are bonded together so as to lay or flatten upstanding fibers to a more or less common level and to provide a hardened or more rigid surface to enable the non-woven backing or support fabric to pass beneath the needles of a tufting machine without difficulty.

With polypropylene fibers, the fibers on the surface of the bat may be bonded together by heating them to a temperature sufficient to melt the surface fibers, preferably about 309F above their melting point. This fuses the surface fibers together without affecting the interior fibers and produces exterior surfaces on the backing or support fabric with upstanding fibers flattened and having a harsh or brash feel.

The yarns forming the pile loops are stitched on to the non-woven backing or support fabric described above after the surface treatment by the usual tufting machines as mentioned previously. In this operation, sewing-machine needles which carry the pile-forming yarns, pass through the backing or support fabric from the rear face thereof until yarn loops of the desired length are formed and are then withdrawn with the yarn loops remaining in place. The backing fabric is then advanced until the point where the next pile elements are to be formed is opposite the needles.

Thus, the backing fabric in this condition has closely spaced needle punctures therein, extending in both lengthwise and widthwise directions, through which punctures the pile-forming yarns extend with portions of the yarns extending lengthwise along the rear face of the backing fabric between successive punctures in a lengthwise direction.

Ordinarily, needle punctures in a backing or support fabric which take place in tufting tend to weaken the fabric to some extent, and this is particularly true with woven fabrics such as burlap where strands may be severed by the needles if care is not exercised. However, it has been found that the tensile strength of the non-woven backing fabric made in accordance with the present invention is not appreciably reduced or diminished by the tufting and an increase in the overall tensile strength of the tufted pile fabric may result due to the compacting of the unbonded or unfused fibers in the interior or center of the backing fabric in areas adjacent to the needle punctures.

Tensile-strength tests made of samples of non-woven backing fabrics of several weights (8 oz., 6 oz., and 4 oz. fabrics) have shown this to be the case. In addition it has been found that the unbonded or unfused fibers in areas surrounding the tufting-needle punctures have a tendency to close on the pile forming yarns which extend through the punctures and thus hold these yarns in place more effectively than is the case with loosely woven backing fabrics. Further, the non-woven backing fabric may be readily sealed by fusing along selvedge edges or cuts made in the tufted fabric.

A very distinct advantage of the non-woven backing fabric described above over woven backings such as burlap is that no skewing of filling strands can take place and distortion in alignment of pile elements resulting therefrom is eliminated.

After the pile-forming yarns have been tufted on to the backing or support fabric, a suitable adhesive compound forming the backcoating 14 is supplied to the rear face of the tufted backing fabric to anchor and hold the pile elements in place. A suitable backcoating compound for this purpose is a high-solids synthetic latex-base adhesive compound, such as is commonly used for this purpose.

In this connection, it should be noted that the non-woven backing or support fabric remains porous and the unbonded or unfused fibers on the interior thereof have the ability to absorb a considerable amount of the backcoating compound without having the compound penetrate to the face of the pile fabric.

Thus, the handle of the tufted pile fabric can be varied by adjusting the amount of the adhesive compound applied thereto. If desired, scrim or other suitable finish or covering may be applied to the rear face of the tufted pile fabric in the usual manner.

The manner in which the non-woven backing or support fabric described is produced is illustrated schematically in Figs. 9 and 10. Briefly, polypropylene fibers (or mixtures containing polypropylene fibers) are fed from feed boxes 30 onto garnets 31 which combine the fibers into layers which pass onto run-out chutes 32. The run-out chutes traverse back and forth over a traveling conveyor or supporting element 33 which, as mentioned above, may be the low-count cheesecloth 15 and deposit the fiber layers thereon.

It is generally desirable to deposit more than one layer of the fibers on the conveyor element so as to obtain a more even and uniform distribution of the fibers.

The conveyor element is fed from a roll 34 through a J-box 35 from which it moves forward beneath the ends of the traversing run-out chutes and thence, to a needling machine 36 carrying the layers of fibers deposited thereon with it. After leaving the needling machine, the needled web or bat passes through another J-box 37 to a pair of heated rolls 38 and 39 which contact the exterior surfaces of the needled web or bat.

In order to fuse fibers of polypropylene having a melting point of between 310° to 320°F., the surface fibers should be heated briefly to a temperature between 325° and 350°F. by contact with the rolls. When the surface fibers are heated in this manner, the fibers in the center or interior of the web will remain unbonded or unfused. The exterior surfaces of the web are then permitted to cool and the web is wound into a roll 40.

The web may be run through a disc cutter to cut it to the desired width either before or after the surface treatment. Also, a suitable binder or solvent, such as an acrylic resin or a water-resistant curable latex may be sprayed on to the surfaces of the web in liquid form and then dried to bind the surface fibers together in place of fusing them by heat.

The various pieces of apparatus mentioned above are conventional and hence need not be described in detail here.

It will be understood that various changes and modifications may be made by those skilled in the art in the particular embodiments of the tufted pile fabric and the method of producing the same which have been described above for illustrative purposes without departing from the scope of the invention as defined by the following claims.

WHAT WE CLAIM IS:—

1. A non-woven fabric, for use as a backing in tufted-pile fabrics, which comprises a bat comprising fibers intermixed vertically by needling, the fibers forming at least one exterior surface of said bat being bonded together into a flattened and hardened condition, and the remaining fibers being unbonded.

2. A fabric according to claim 1, in which at least a part of the fibers are of thermoplastic material.

3. A fabric according to claim 2, in which said thermoplastic material is polypropylene.

4. A fabric according to any one of the preceding claims, in which all the fibers are of polypropylene material.

5. A fabric according to claim 4, in which the fibers range in size from 5 to 15 denier.

6. A fabric according to any one of the preceding claims, in which the fibers on both exterior surfaces of the bat are bonded together into flattened and hardened surfaces.

7. A fabric according to any one of the preceding claims, in which the bat includes a piece of cheese cloth.

8. A non-woven fabric substantially as hereinbefore described and as illustrated in the accompanying drawings.

9. A tufted pile fabric such as carpet which includes a non-woven backing fabric according to any one of the preceding claims, yarns forming pile elements extending through punctures formed by tufting needles in said backing fabric at spaced intervals for a distance beyond a front face of the non-woven backing fabric and extending along a rear face of the non-woven backing fabric between said punctures and a coating of an adhesive compound on the rear face of the non-woven fabric said adhesive compound penetrating into the backing fabric from the rear face thereof and securing the pile yarns thereto.

10. A fabric according to claim 9, in which the unbonded fibers located between the bonded exterior surfaces are compacted by the tufting needles in areas adjacent to the punctures in the backing fabric.

11. A tufted pile fabric such as a carpet substantially as hereinbefore described and as illustrated in the accompanying drawings.

12. A method of forming a non-woven fabric for use as a backing in tufted pile fabrics which comprises forming a web comprised of a layer of randomly distributed fibers, needling the fibers throughout said layer into an intimately intermixed relation relative to each other and imparting cohesive strength to the web thereby, and then bonding together fibers on at least one exterior surface of the layer into a flattened and hardened surface condition, the remaining fibers being unbonded.

13. A method according to claim 12, in which the fibers are deposited on a moving conveyor and are passed thereon to the needling operation.

14. A method according to claim 12 or 13, in which fibers are bonded together on both exterior surfaces of the layer.

15. A method according to any one of claims

12 to 14, in which at least part of the fibers forming the web are thermoplastic, and the thermoplastic fibers on the exterior surface or surfaces of the needled web are fused together to a flattened and hardened condition by applying heat thereto.

16. A method according to claim 15, in which the thermoplastic fibers are polypropylene fibers.

17. A method according to any one of claims 12 to 16, in which all of the fibers are of polypropylene.

18. A method according to claim 17, in which the fibers on one or both exterior surfaces of the non-woven web are heated to a temperature of about 30°F. above their melting point without melting the fibers on the interior of the non-woven web.

19. A method of forming a non-woven fabric for use as a backing in tufted pile fabrics substantially as hereinbefore described and as illustrated in the accompanying drawings.

20. A method of producing a tufted pile fabric such as carpet, which comprises passing yarn-carrying needles repeatedly through a non-woven fabric produced by the method according to any one of claims 11 to 18, at spaced intervals from a rear face thereof, said yarn-carrying needles forming spaced punctures on the said non-woven fabric through which the yarns extend to a point beyond a front face thereof to form tufted-pile elements of yarn on said fabric.

21. A method according to claim 20, which includes applying an adhesive back-coating compound to the rear face of the tufted fabric.

22. A method of forming a tufted pile fabric such as a carpet substantially as hereinbefore described and as illustrated in the accompanying drawings.

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Agents for the Applicants.

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Fig. 1

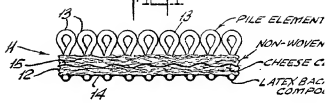



Fig. 4.

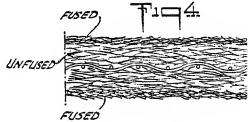
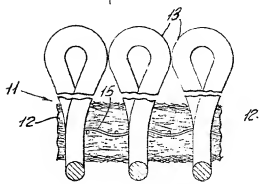



Fig. 5.



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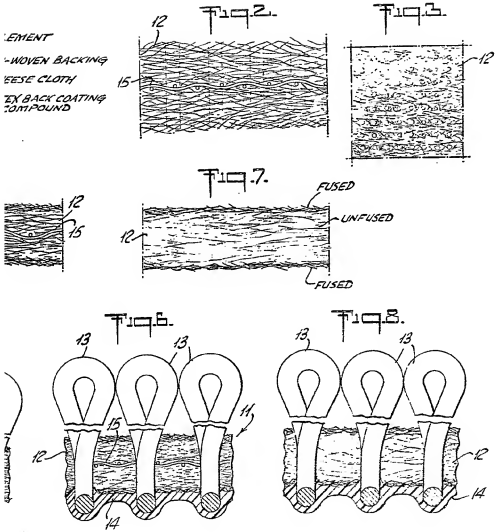

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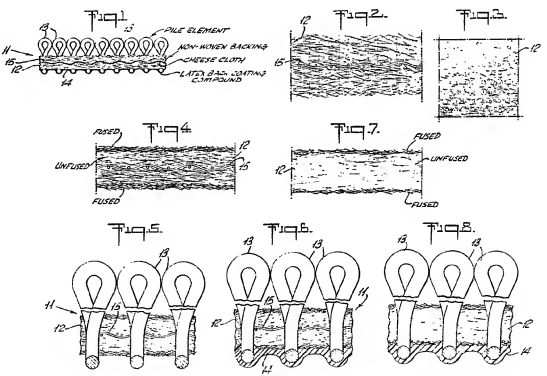

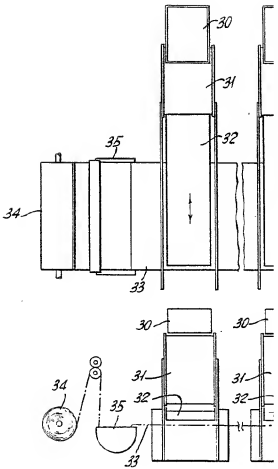
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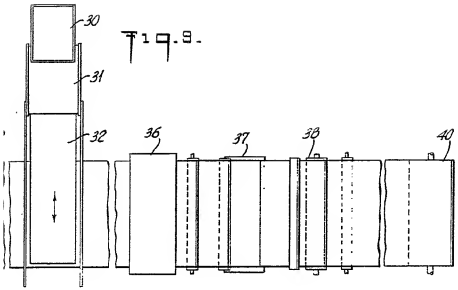


Fig.9.

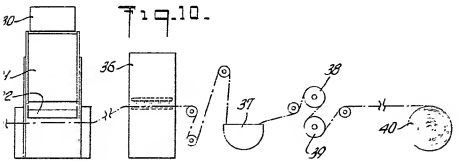


Fig.10.

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Fig.9.

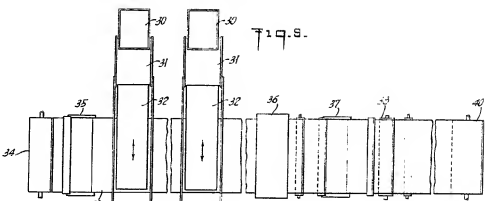


Fig.10.